Name: ____________________ **Date:** __________________

Math 10F&PC Chapter 4 Roots and Powers

4.1 Estimating Roots

(n) root of (x)

Explaining the meaning of the index of a radical In the $\sqrt[n]{x}$ the __n__ called the __index__ of the radical and x is the __radicand__.

Since $3^2 = 9$, 3 is a square root of 9. We write: __3__ = $\sqrt[2]{9}$ square root

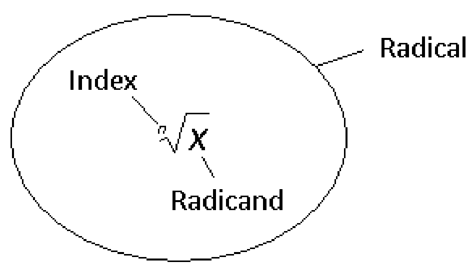
Since $3^3 = 27$, 3 is the cube root of 27. We write: __3__ = $\sqrt[3]{27}$ cube root

Since $3^4 = 81$, 3 is a fourth root of 81. We write: __3__ = $\sqrt[4]{81}$ Fourth root of 81

How would you write 5 as a square root? $\sqrt{5}$

A cube root? $\sqrt[3]{5}$

A fourth root? $\sqrt[4]{5}$



Definition of a Root: the number that when multiplied by itself a number of times to get the value under the root sign

$\sqrt[3]{27} = 3$ 3.3.3 =

The Index tells us: How many times the root is multiplied by itself $\sqrt[4]{81} = 3$ 3.3.3.3

The Radicand is: the number underneath the radical symbol

Estimating Roots: To estimate square roots, write the two consecutive perfect squares closest to the number, then estimate. Square the estimate and use this value to revise the estimate. Keep revising until the square of the estimate is within 1 decimal place of the original number.

Estimating cube roots and fourth roots follow a similar strategy. NC

Example: Estimate the value of

$\sqrt[2]{20}$,

$4^2 = 16$

$5^2 = 25$

$\sqrt{20}$ between $\sqrt{16}$ and $\sqrt{25}$

$\simeq 4.5$ ✓

$\sqrt[3]{20}$

$2^3 = 8$

$3^3 = 27$

$\therefore \sqrt[3]{20} \simeq 2.7$ try

$2.7 \times 2.7 \times 2.7 = 19.683$

$\sqrt[4]{20}$

$2^4 = 16$

$3^4 = 81$

$\sqrt[4]{20} \simeq 2.1$ ✓

$2.1^4 = 19.44$

Example: Estimate

a) $\sqrt{79}$ $\simeq \boxed{8.9}$

between 8 & 9

b) $\sqrt[3]{79}$ $\simeq 4.5$ ✗ $\simeq 4.4$ ✗

between 4 & 5 $\doteq \boxed{4.3}$

Rational Numbers are: a number that can be written as fraction $\frac{m}{n}$ $n \neq 0$, All terminating and repeating decimal

$\frac{3}{7} = 0.42857$

$= 0.9\overline{1111}$

Irrational Numbers are: a number that can not be written as fraction $\frac{m}{n}$

All non terminating and non repeating decimals, π

$\sqrt{5}$, $\sqrt[3]{36}$ are other examples.

Copy and complete this table. Use the strategies from Steps A to C to determine the value of each radical.

Radical	Value	Is the Value Exact or Approximate?
$\sqrt{16}$	***4***	***Exact***
$\sqrt{27}$	***5.1962***	***Approximate***
$\sqrt{\frac{16}{81}}$	$\frac{4}{9}$ ***or*** $0.\overline{4}$	***Exact*** $\frac{\sqrt{16}}{\sqrt{81}} = \boxed{\frac{4}{9}}$ Exact
$\sqrt{0.64}$	0.8	Exact number $\sqrt{64} = 8$ $\sqrt{0.64} = 0.8$
$\sqrt[3]{16}$	2.52	$2 < \sqrt[3]{16} < 3$ Approximate $\sqrt[3]{16} \doteq 2.5$ × $\simeq 2.52$ ✓
$\sqrt[3]{27}$	3	Exact
$\sqrt[3]{\frac{16}{81}}$	$\frac{2.52}{4.325} = 0.5826$	$\sqrt[3]{16} \doteq 2.52$ $\sqrt[3]{81} \doteq 4.325$ Approximate
$\sqrt[3]{0.64}$	0.862	$0.8 < \sqrt[3]{0.64} < 0.9$ Approximate $\simeq 0.85$ × $\simeq 0.86$ $\doteq 0.862$
$\sqrt[3]{-0.64}$	−0.862	Approximate
$\sqrt[4]{16}$	2	Exact
$\sqrt[4]{27}$	2.28	$2 < \sqrt[4]{27} < 3$ Approximate $\sqrt[4]{27} \simeq 2.1$ $\simeq 2.2$ $\doteq 2.3$ $\simeq 2.28$
$\sqrt[4]{\frac{16}{81}}$	$\frac{2}{3}$	$\frac{2}{3} = 0.\overline{6}$ Exact

Assignment: p. 206 Q#1–6